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NOTES FOR STUDENTS.

YABE [7] gives his opinion that COVILLE'S ericaceous genus Arcterica,[8] from Bering Island, is *Pieris nana* Makino, common on the higher peaks in Honshu and Hokkaido, Japan. The plant was originally described as *Andromeda nana* Maxim., of which genus Pieris is often regarded as a section.—J. M. C.

HOLM [9] has been investigating the inflorescence of Cyperus, chiefly with reference to the prophylla. It is claimed that by means of the "cladoprophyllon" the originally erect and congested rays of the umbel are brought to their more or less horizontal position. Also, the small bodies always observable at the base of the secondary branches of the inflorescence of grasses, more distinct in large panicles, are said to represent rudimentary prophylla identical with those characteristic of the Cyperaceae.—J. M. C.

FUJII [10] in a short preliminary announcement gives the results of his investigations upon the droplet which exudes from the micropyle of gymnosperms at the time of pollination. The preliminary announcement deals with *Taxus baccata*. Chemical tests indicate that the droplet contains glucose and calcium. A kind of gum and perhaps also malic acid are present. SCHUMANN claimed that only one droplet is produced. The present investigation shows that droplets may be formed repeatedly, both in the laboratory and in the field.—CHARLES J. CHAMBERLAIN.

VERSCHAFFELT [11] finds that the minimum lethal strength of some toxic solutions for fleshy or succulent organs of potato, Aloe, Rheum, etc. can be determined with fair accuracy by noting the change in weight which occurs when the test object is removed from the toxic solution and immersed in water. The basis of the method is that tissues which have succumbed to toxic exposure lose in weight by yielding osmotically held water, or at least do not gain in weight by water absorption as compared with controls. The method has limitations, some of which are noted by the author.—RAYMOND H. POND.

THE EXPERIMENTS upon which Elfving based his theory of positive and negative galvanotropism have been repeated by PLOWMAN [12] with results for the most part confirmatory. Two exceptions to be noted are, first, that an electric current passing through water in which seedlings are growing is not necessarily fatal, and that the roots of such seedlings will curve toward the positive pole even when the current is of less than lethal strength; second, that negative galvanotropism is not a constant property of any species thus far studied. Since electrons instead of ions are the cause of the curve responses the author proposes to substitute for Elfving's "galvanotropism" the term "electrotropism."—RAYMOND H. POND.

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[7] YABE, Y., On a new genus Arcterica. Bot. Mag. Tokyo **18**: 127–128. 1904. Abstract.

[8] See BOT. GAZ. **37**: 298–302. 1904.

[9] HOLM, THEO., Studies in the Cyperaceae. XXIII. The inflorescence of Cyperus in North America. Am. Jour. Sci. IV. **18**: 301–307. 1904.

[10] FUJII, K., Ueber die Bestäubungstropfen der Gymnospermen. Vorläufige Mitteilung. Ber. Deutsch. Bot. Gesells. **21**: 211–217. 1903.

[11] VERSCHAFFELT, E., Determination of the action of poisons on plants. Konin. Akad. Wetens. Amsterdam **1904**: 703–707.

[12] PLOWMAN, A. B., Electrotropism of roots. Amer. Journ. Sci. IV. **18**: 228–236. *pls. 9–10.* 1904.

NEWCOMBE[13] reports experiments on thigmotropism of terrestrial roots which show very feeble sensitiveness of the terminal millimeter and of the growing region, the few responses being positive and the angle of deviation small. Many ingenious modes of securing continuous pressure and avoiding hydrotropic stimuli as far as possible were tried. The most convincing results were gained by surrounding roots with collapsible collodion tubes, and using a water stream to give the pressure. The tubes do not allow appreciable filtration. These experiments gave strong evidence for the identity of rheotropism and thigmotropism, and NEWCOMBE applies to thigmotropism the results given by his earlier experiments on rheotropism.[14] The sensitiveness is equal on all sides, and the stimulation must extend over a considerable area and be continued for some time to produce a complete reaction. The feeble sensitiveness is probably of no utility to the plant.—C. R. B.

BRANDT holds[15] that REINKE errs in thinking the N-content of the sea small[16] because little is added to it. His estimates of the yearly addition of organic N-compounds and of inorganic N-compounds by rains would indicate an N-content in sea water that analysis does not corroborate. This discrepancy is explained by the active dentrification through the action of bacteria, so that the N-content never surpasses a minute amount. This dentrification has been shown to occur and the bacteria have been carefully studied in several localities in the North Sea, the East Sea, and even in the Antarctic under the ice. It is the chief reason for the smaller N-content of tropical waters and this difference determines the lesser amount of plant life there. BRANDT believes the N-supply quite adequate without special appeal to such bacterial symbionts as Clostridium and Azotobacter, though these insofar as they occur may be effective. For example, in the water of Kiel Bay (at 20^{m}) the content in inorganic N is four times that of the plankton.—C. R. B.

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[13] NEWCOMBE, F. C., Thigmotropism of terrestrial roots. Beihefte Bot. Cent. **17**:61–84. 1904.

[14] BOT. GAZ. **33**: 183. 1902.

[15] BRANDT, K., Ueber die Bedeutung der Stickstoffverbindungen für die Production im Meere. Beihefte Bot. Cent. **16**: 383–402. 1904.

[16] REINKE, J., Die zur Ernährung der Meeres-Organismen disponiblen Quellen an Stickstoff. Ber. Deutsch. Bot. Gesells. **21**: 371–380. 1903. See BOT. GAZ. **37**: 228. 1904.

PILOSTYLES is a genus of the Rafflesiaceae parasitic upon various Leguminosae. Material from Brazil has been studied by ENDRISS [17] in GOEBEL'S laboratory. The staminate flower consists of a solid axis in which are imbedded two circles of sporangia, with 18–20 sporangia in each circle, twenty being probably the usual number. If four sporangia represent one anther, the whole structure would represent five anthers, corresponding in some measure to the relations obtaining in the ovulate flower, which has normally five placentae. While the flowers are monosporangiate, a rudiment of the ovary appears as a column in the center of the staminate flower. In related forms the flowers are said to arise endogenously, within an originally compact tissue. In *Pilostyles Ingae* the flowers are strictly exogenous. The pollen grains are extremely small, measuring only 5μ in diameter. Some flowers have been pollinated, but in only one case had pollen tubes begun to form. Many older seeds contained embryos, but no trace of pollen or pollen tubes could be found. The writer doubts whether normal fertilization occurs. The anatomy of the plant and the development of the embryo are described.—CHARLES J. CHAMBERLAIN.

VARIOUS ATTEMPTS have been made to attribute to external conditions the polarity seen in cuttings of roots and shoots. The latest effort is by KÜSTER, who discusses in a preliminary paper[18] the influence of oxygen and of centrifugal force upon polarity, and in a second [19] enlarges upon the same topic. KÜSTER placed the roots of Taraxacum, which under uniform conditions of moisture produce roots at the apical (normally lower) end and shoots at the basal end, with their basal (normally upper) ends in water and the opposite ends pointing upwards into the air. Shoots develop on the latter end and none on the parts in water. Cuttings of the stems of *Ribes aureum* placed with their basal ends in water and their apical ends in moist air produced roots only on their apical ends. *Salix vitellina* gave similar results, showing a marked tendency for the roots to appear only where there is a sufficient supply of air. Cuttings of Salix and other plants were rotated horizontally on a centrifuge. The centrifugal force acted as a check upon development, the inhibition being in proportion to the force, *i. e.*, if the apical end describe the greater circle the buds there are inhibited more than those at the opposite end. In this way the usual polarity may be reversed.—W. B. MACCALLUM.

LYON[20] has made a detailed and much-needed study of the embryogeny of Ginkgo, with an unusual abundance of illustration. The general undifferentiated mass of tissue that is known to fill the egg after free nuclear division is called the "protocorm." The cells in the micropylar two-thirds of this spherical protocorm divide little or not at all, but the cells of the antipodal extremity form a small-celled meristem which passes over directly into the meristem of the "blastema" or "metacormal bud." The blastema invades the endosperm as a broad, blunt cylinder, the protocormal tissue being forced back through the neck of the archegonium, many of its cells often being crushed. The metacormal bud is meristematic throughout, but soon two "growth-foci," those of stem and root, are organized in its axis and very close together. Later the primordia of the two cotyledons are organized in the marginal region of the broad apical meristem. Thus in the organization of the embryo much of the original protocormal tissue is not involved, heretofore being described as a rudimentary suspensor. There are usually two cotyledons, but in certain of the material three cotyledons were quite common; they are normally equal and entire, and spring apart when liberated from the seed. The anatomy of the embryo, including its histogenesis, is also described.—J. M. C.

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[17] ENDRISS, W., Monographie von *Pilostyles Ingae* (Karst.). (*Pilostyles Ulei* Solms-Laub.) Flora **91**: 209–236. *pl. 20. figs. 31.* 1902.

[18] KÜSTER, ERNST, Experimental Untersuchungen über Wurzel- und Sprossbildung an Stecklingen. Ber. Deutsch. Bot. Gesells. **22**: 167–170. *pl. 1.* 1904.

[19] KÜSTER, Beiträge zur Kenntnis der Wurzel und Sprossbildung an Steckling. Jahrb. Wiss. Bot. **40**: 279–302. *figs. 4.* 1904.

[20] LYON, HAROLD L., The embryogeny of Ginkgo. Minn. Bot. Studies **3**: 275–290. *pls. 29–43.* 1904.

BESSEY has studied the effect of various external factors on the pigment formation in several fusarium-like fungi.[21] The plants used were (1) two fungi, closely resembling each other, isolated from the roots of diseased sesamum plants, (2) *Neocosmospora vasinfecta* and (3) its variety *nivea*, and (4) *Fusarium culmorum*. Of these the first four when grown on acid media produce a red pigment which changes to dark blue when treated with alkalies. The fungi were grown in KNOP'S solution to which the substances to be tested were added. No general relation could be established between the composition of the culture medium and the production of pigment. Mono-, di-, tri-, and polysaccharides generally gave a red or violet pigment, which changed to blue in cases where the culture became alkaline during the experiment (gelose). Organic acids gave a scarlet color, except palmitic acid which is not soluble. Salts of the acids with few exceptions gave no pigment. In alkaline media no pigment production takes place. Absence of air also suppresses the development of the coloring matter. These fungi also produce a yellow pigment whose formation is independent of the character of the substratum. Light and oxygen are necessary for its production. The pigments are formed in the cells of the fungi and not primarily in the substratum as has been stated.—H. HASSELBRING.

SHIBATA'S[22] mycological studies of endotrophic mycorhizas in Podocarpus, Psilotum, Alnus, and Myrica have given the following results: In the tubercles of Podocarpus the mycelium of the fungus develops extensively, and is then digested and resorbed by the cells of the host. The nucleus of the infected cell divides repeatedly amitotically, the nuclei increasing greatly in staining capacity on account of the increase in a nuclein-like material. After the digestion of the fungus the nuclei of the host cells resume their normal appearance. The increase and subsequent decrease in the nuclein-like material indicates that the nucleus takes part in the formation of enzymes. The amitotic division is not an indication of degeneration, but is rather a means of increasing more rapidly the nuclear material. After the fungus has been digested, mitotic division is often seen in the multinucleate cells, showing that nuclei after dividing amitotically may again divide by mitosis. The number and arrangement of the chromosomes does not seem to be affected by the previous amitotic division. In Psilotum the cells containing the fungus can be distinguished as host cells and digesting cells. The nuclear change consists chiefly in a great increase in the chromatin. The formation of transverse walls in the intracellular hyphae is almost entirely suppressed. In Alnus the fungus is not a true hyphomycete. A plasmatic body appears in the nucleus of the infected cell, and within the body are numerous droplets which disappear after digestion of the fungus has been completed. The fungus in Myrica belongs to the genus Actinomyces, the first instance of actinomycosis recorded.

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[21] BESSEY, Ernst A., Ueber die Bedingungen der Farbbildung bei Fusarium. Flora **93**: 301–334. 1904.

[22] SHIBATA, K., Cytologische Studien über die endotrophen Mykorrhizen. Jahrb. Wiss. Bot. **37**:643–684. *pls. 14–15.* 1902.

In all the mycorhizas studied the cytological changes are intimately connected with the intracellular digestion of the fungus substance. The presence of a typical digestive fluid was established in all cases. The mode of nutrition of the endotrophic fungus is still an open question.—CHARLES J. CHAMBERLAIN.

AMAR [23] has recorded data obtained from histological and physiological study of the rôle of calcium oxalate in plant nutrition. As a general rule the root contains few if any crystals, and they become less numerous as one follows the course of foods from the leaf blade to the root. Crystal formation in the leaf is localized chiefly in tissues adjacent to those concerned with photosynthesis and conduction. The crystals represent excreted waste and not reserve products in storage. AMAR seeks to relate the formation of oxalate crystals to physiological conditions resulting from the chemical composition of the nourishment absorbed, but in the opinion of the reviewer he does not present convincing evidence. He found that each species has a minimum requirement for Ca, up to which crystals do not form, and above which they form in proportion as the Ca exceeds the minimum requirement. Since crystals do not form in seedlings grown without any calcium, the author attributes the retarded growth in such cases to deficiency of this element, and concludes that the crystals form under natural conditions to reduce the excess of calcium rather than to remove oxalic acid from solution. The justification for this conclusion is not apparent, because the experiment as tried does not exclude the presence of oxalic acid as a possible factor. In the opinion of the reviewer an important fact has been overlooked, namely that a molecule of oxalic acid consisting of just two carboxyl groups requires only the addition of one atom of oxygen for complete oxidation to carbon dioxid and water. For this reason an abnormal excretion of oxalic acid in animal metabolism has always been regarded as evidence of incomplete oxidation. Since calcium oxalate occurs in fungi as well as in green plants, it is quite possible that oxalic acid means incomplete oxidation for plants as well as for animals. The author's experiment would then be interpreted thus: an excess of calcium retards oxidation and hence favors oxalic acid formation; rather than that oxalic acid is formed especially to remove excess of lime.—RAYMOND H. POND.

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[23] AMAR, MAXIME, Sur le rôle de l'oxalate de calcium dans la nutrition des végétaux. Ann. Sci. Nat. Bot. VIII. **19**: 197–292. *figs. 34.* 1904.

TOBLER[24] experimented at the Zoological Station of Naples upon fragments of living Rhodophyceae taken from the detritus zone of the bay. He finds motion essential to keep the thallus of some algae intact. *Griffithsia Schousboei*, for instance, grew well upon a shaking machine, but fell to pieces in a day when kept quiet. Bornetia, which normally has straight branches, only the claw-like branches about the fruiting organs being hyponastic, in darkness developed such branches at the tip of the plant. Lack of light produces abnormal growth and other effects. For example, alternately branched forms in the dark became oppositely branched, and oppositely branched species became whorled. Terminal cells of *Antithamnion plumula* became elongated, lighter colored, and hair-like. Callithamnion lived three and one half months in complete darkness—longer than it had ever been cultivated in light. Dasya grew more luxuriantly in yellow light. About ten cells from the tip of the axis intercalary growth was induced. Etiolation phenomena represent only a general form of reaction, because cultures of a number of algae in the light show typical etiolation, which the author calls phenomena of degeneration. Intercalary growth may occur normally in Pleonosporium and its relatives, yet it is more common in cultures placed in the light. After eight to fourteen days in darkness every cell of the axis not rarely began to form cross walls. Later, intercalary growth occurred in the large branches also. Adventive sprouts and rhizoid-like branches are common characteristics of degeneration. The cortex, which is an important taxonomic feature in many red algae, was found to be variable. Pleonosporium, which has no cortex in nature, developed one in the dark. The youngest cells of Griffithsia often fell off singly in darkness, and in darkness or in yellow light Bornetia fell into filaments or separate cells. Such isolated cells or cell complexes may bud and develop new plants. In contrast to these forms, *Callithamnion granulatum* often cast off young cells which never formed proliferations, but quickly died. The author explains this peculiarity by the intimate correlation between the cells of Callithamnion, which makes it impossible for them to become separated and remain alive.—ETOILE B. SIMONS.

THE ATTITUDE of experimental morphologists of the present day is decidedly toward a causal explanation for the behavior of organisms, as opposed to the teleological view of the past. REINKE,[25] in a lengthy discussion, strenuously opposes this point of view and argues for a "final" (which he makes synonymous with teleological) explanation. REINKE cites as illustrations upon which his argument is based the behavior of *Nuphar luteum* and *Ranunculus aquatilis* which in flowing water produce no floating leaves or flowers, of *Euphorbia Cyparissias* whose shoots are distorted by a rust fungus, and of *Lentinus lepideus* which in darkness develops a branching non-fruiting form. These cases he considers as undoubted malformations because they are forced departures from the normal type. In Nuphar, for example, the form developed in still water is "abnormal," though it always occurs under these conditions. This character, REINKE claims, not being "normal" is not hereditary; only the capability of reaction to this stimulus is hereditary. One is tempted to ask here, what is the "normal" form of this plant but evidence of its capability of reaction to the conditions of still water?

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[24] TOBLER, F., Ueber Eigenwachsthum der Zelle und Pflanzenform. Versuche und Studien an Meeresalgen. Jahrb. Wiss. Bot. **39**: 527–577. *pl. 10.* 1903.

[25] REINKE, J., Ueber Deformation von Pflanzen durch äussere Einflüsse. Bot. Zeit. **62**^{1}: 81–112. *pl. 4.* 1904.

The branched non-fruiting form of Lentinus occurring in the absence of light REINKE discusses at length, and claims it to be a true malformation because it is the result of abnormal conditions, while the fruiting form is "normal" because it is the result of "normal" conditions, the test of normal or abnormal conditions here being very apparently whether they are the rule or the exception in nature. Such "abnormal" modifications according to REINKE all have this character, that they are not necessary for the life of the plant, and are not hereditary, but only potentially so, in that they occur only as reactions to definite stimuli, *i. e.*, the reaction ability is hereditary. When an organism responds to two different sets of stimuli by definite reactions in each case it seems to the reviewer rather futile to argue that one response is normal and the other is anything else.

KLEBS'S work is freely quoted, and REINKE, as would be expected, takes exactly the opposite view, maintaining that there is a definite form which the plant is striving to assume, but when certain inhibiting conditions exert their influence the morphological equilibrium is disturbed and the plant, against its innate forces, is compelled to assume another form. These external factors REINKE considers as opposed to the "normal" form, and the plant, so to speak, resists them.—W. B. MACCALLUM.

ITEMS OF TAXONOMIC INTEREST are as follows: K. SCHUMANN (Bot. Jahrb. **34**: 325. 1904) has described a new African genus (*Stephanostema*) of Apocynaceae, and also (*idem* 331) one (*Dolichometra*) of Rubiaceae.—W. H. BLANCHARD (Amer. Botanist **7**: 1–4. 1904) has published a new species of Rubus (blackberry), with a variety, from Vermont.—H. CHRIST (Bull. Herb. Boissier **4**: 936–951. 1904) has described new species of Hymenophyllum (12), Trichomanes (2), Cyathea (9), and Alsophila from Costa Rica.—P. HENNINGS (Hedwigia **43**: 353–400. 1904), in concluding his Ule's *Fungi amazonici*, has described as new genera *Saccardomyces* (Englerulaceae), *Zukaliopsis* (Perisporiaceae), *Asteropeltis* and *Phaeoscutella* (Microthyriaceae), *Metadothella* (Pseudophacidiaceae), *Cicinnobella*, *Diplodiopsis*, and *Septodothideopsis* (Sphaeropsidaceae), *Poropeltis*, *Peltistroma*, *Seynesiopsis*, and *Phragmopeltis* (Leptostromataceae), and *Bactridiopsis* (Tuberculariaceae).

—W. LIPSKY (Acta Hort. Petrop. **23**:1–247. *pls. 1–11.* 1904), in his second contribution to the flora of central Asia, which includes Ranunculaceae to Labiatae, besides numerous new species describes two new genera (*Kozlovia* and *Ladyginia*) of Umbelliferae.—A. A. HELLER (Muhlenbergia **1**:63–110. 1904) has brought together the species of Ribes in California, with a key, recognizing 43 species, one of which is described as new; and has also described new species of Heuchera, Sidalcea, Eriodictyon, and Orthocarpus.—E. P. BICKNELL (Torreya **4**:129–132. 1904) has described three new species of Viola from Long Island.—W. A. MURRILL (*idem* 141–142) has described a new genus (*Phylloporia*) of pore-fungi from South America.—N. L. BRITTON (*idem* 142) has described a new species of Bradburya from Florida.—E. L. GREENE (Leaflets **1**:49–64. 1904) has read the riddle of NACKER'S genera of Cactaceae (all of them happily synonyms); has called attention to Amarella as the proper name of the American species referred to Gentiana, describing under it eight new species; and has described seven new species of Apocynum and five new western species of Rhamnus.—ANNA MURRAY VAIL (Bull. Torr. Bot. Club **31**:457–460. *pls. 16–19.* 1904) has published two new species of Asclepias from New York and one from Kansas.—T. D. A. COCKERELL (*idem* 461–509. *pls. 20–23*) has published an account of the N. Am. species of Hymenoxys (formerly referred to Picradenia or Actinella), recognizing thirty species and varieties, describing eleven as new, and transferring seventeen.—J. N. ROSE (Smithsonian Miscell. Coll. **47**:159–162. *pl. 20. fig. 18.* 1904) has published a new genus (*Lenophyllum*) of Crassulaceae, comprising four species from northeastern Mexico and southern Texas.—J. M. C.

A VOLUMINOUS monograph on anthocyanin by BUSCALIONI and POLACCI [26] is in three parts. The first is a bibliography, presumably exhaustive, as it contains 866 titles, among which are Linnaeus's *Flora Lapponica* and Loudon's *Arboretum.* The industry of the authors in gathering titles has exceeded their discrimination, as the inclusion of a paper by a Mr. ROBINSON, entitled *Blue Ridge blossoms*, will testify, since it is purely a floristic list and the Blue Ridge does not owe its color to anthocyanin. The second part (114 pp.) is a critico-historical discussion of the researches of previous authors. The third part (255 pp.) contains an account of the very extensive researches of the authors, which have continued for two years. The gist of their results is here given, condensed from their own summary.

Anthocyanins appear only in highly developed plant forms. Their distribution in the parts of different plants does not accord with that of starch and indicates that they have more than one function, just as their formation depends on more than one factor. Comparative studies show that the presence of anthocyanins often involves a modification of cells. Their origin seems due to oxidases acting on sugars, glucosides, etc., while their decomposition is oftenest due to reduction. The influence of humidity, of nutrition, and of light upon them are very variable.

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[26] BUSCALIONI, LUIGI, e POLACCI, GINO, Le antocianine e loro significato biologico nelle piante. Atti Istituto Botanico di Pavia II. **8**: 135–511. *pls.* 9. 1904.

They apparently tend to moderate rather than to accelerate transpiration. The relations of anthocyanins to parasitic organisms show that anthocyanic cells react against the invader by augmenting their osmotic pressure, which is accomplished by accumulating in them substances from which ultimately anthocyanins arise. Thus the pigments at once indicate and participate in the increased turgescence. Study of allogamy leads to the conclusion that floral coloration has not originated from the intervention of insects, but that the crowding of foods into the floral leaves has led first to the starvation of the chloroplasts, later to their modification, and finally to the appearance of the anthocyanic coloration, which became fixed by the agency of insects. To hold that allogamy is the primary cause of coloration seems to require belief that flowers are not only intelligent, but can voluntarily and freely alter their own bodily characteristics with varying external conditions. Finally, as the chromatic evolution of flowers is found to be probably polyphyletic, the anthocyanins can hardly have arisen from the xanthic pigments or *vice versa*. A new reagent for the anthocyanins—a solution of nicotin—is found to be the most reliable.

This monograph, which the authors call *un modesto contributo* to the study of biological problems, suffers from hypertrophy. A more careful bibliography, confined to legitimate references, a compact relation of the discordant results of previous investigators, and a condensed presentation of their own work would have insured wider attention to an important paper than can be given it in its present voluminous form by any except special students of plant pigments.—C. R. B.

THE RECONSTRUCTION of the nucleus and the formation of the chromosomes in vegetative mitoses is the title of an important paper by GREGOIRE and WYGAERTS.[27] The material studied was the roots of *Trillium grandiflorum* and the homotypic division in the pollen mother-cells of *T. cernuum*. The conclusions in many cases differ decidedly from the commonly accepted views.

Telophase in root tips. After the chromosomes have reached the poles, one sees surrounding and bathing the mass of chromosomes the liquid which will constitute the nuclear sap. The liquid increases rapidly and causes the formation of the nuclear vacuole and nuclear membrane. On this point the writers are quite in accord with the recent view of LAWSON.[28] Each chromosome, through a gradual process of alveolarization, becomes resolved into a network, so that the entire nuclear network is a network of networks. In the resting nucleus within the membrane the chromatic network, lying in the nuclear sap, is (with the exception of the nucleolus) the only constituent. The nuclear membrane forms in immediate contact with the chromosomes, so that if any cytoplasm is included it is only a few threads of the central portion of the spindle which may become imprisoned. No karyoplasm is formed in the nucleus of Trillium. In passing through the telophase to the resting condition, no continuous spirem is formed.

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[27] GREGOIRE, VICTOR, and WYGAERTS, A., La reconstruction du noyau et la formation des chromosomes dans les cinèses somatiques. 1. Racines de *Trillium grandiflorum* et télophase homoeotypique dans le *Trillium cernuum*. La Cellule **21**: 7–76. *pls. 1–2.* 1903.

[28] LAWSON, A. A., On the relationship of the nuclear membrane to the protoplast. BOT. GAZ. **35**: 305–319. *pl. 15.* 1903.

Prophase in root tips. The nuclear network becomes resolved into alveolar or reticular pieces. A process of concentration and homogenization (*sit venia verbo*) continues until the chromosomes have the form of homogeneous rods. There is no continuous spirem in the prophase and the chromosomes never present the form of an achromatic ribbon carrying chromatic granules. The longitudinal division of the chromosomes begins by the formation of a series of chinks lying along its axis and not by the division of granules. In the nuclear cavity there are no granular or filamentous structures, but only the chromatin (and nucleolus) lying in the nuclear sap.

Telophase of second division in pollen mother-cells. No daughter thread is formed. The nucleus results from the confluence of one or more vesicles each of which contains one or more chromosomes. A chromatic vesicle in Trillium is a vacuole containing a chromosome bathed in nuclear sap. The nuclear membrane is formed by the condensation of the peripheral layer of cytoplasm bordering the nuclear vacuole.

The writers define the nucleus (excepting nucleoli) about as follows: In Trillium the nucleus is a vacuole limited by a cytoplasmic membrane, filled with a nuclear sap in which lies a chromatic network consisting of a homogeneous ground substance, without differentiation into an achromatic substratum and chromatic granules. The network, which arises from the juxtaposition of the networks of the individual chromosomes, apparently retains its composite character during the resting period, and so might be defined as an association of chromosomes which have become alveolar and reticular.—CHARLES J. CHAMBERLAIN.

STRASBURGER[29] in a very important paper on the reduction division expresses views which are quite opposed to his previous interpretations. The observations and discussion deal almost exclusively with the first division in the mother-cell, because there seems to be no ground for interpreting the second division as a reduction division. *Galtonia candicans*, the principal form studied, is particularly favorable, since it has only six chromosomes and is easy to stain. In the pollen mother-cell during the loose spirem stage of the first division the thread shows a longitudinal splitting, but the daughter threads do not separate. The thread becomes shorter, thicker, and simpler, and then divides into six chromosomes which are bivalent, as shown by the fact that each one splits transversely into two. Thus arise twelve chromosomes united in pairs. The pairs assume the various shapes so often observed. After the two parts of each pair have become separated and are nearing the poles of the spindle, a longitudinal fission can be seen. This is the longitudinal fission commenced but not completed in the loose spirem stage. The chromosomes become placed end to end, but are united only by linin threads, and are distinguishable during the short resting period. In the second division the chromosomes split longitudinally along the line indicated in the loose spirem stage of the first division. Consequently, it is the product of the first longitudinal division which becomes separated at the second division, and not the product of a second longitudinal splitting as believed by those who support the theory of a double longitudinal splitting. The first mitosis is a reduction division, the second an equal division (*Aequationsteilung*). Besides the figures of Galtonia, a series of diagrams makes the process easily understood. An examination of Tradescantia gave approximately the same results, but in this form the processes are not so easily observed. The much studied Lilium, though not a favorable form, will bear a similar interpretation.

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[29] STRASBURGER, EDUARD, Ueber Reduktionsteilung. Sitzungsb. Königl. Preuss. Akad. Wiss. **18**: 587–614. *figs. 9.* 1904.

The greatest difficulty in the investigation and the most important part of the discussion concerns the synapsis stage. At this period the chromatin withdraws from the linin thread and collects around twelve centers (*Gamocentren*) corresponding to the twelve chromosomes. The chromatin granules form loose groups, then unite to form bodies in which the separate granules can hardly be distinguished. These bodies elongate, become constricted in the middle, the granules of the two halves begin to separate, and with the aid of the linin form a continuous thread. The entire thread then splits longitudinally. That the twelve bivalent segments of this thread correspond to the twelve bodies counted during synapsis, and that the transverse division of each bivalent chromosome again separates halves of that body, cannot be doubted. The view that there are differentiated chromosomes in the synapsis stage is consequently incorrect. Rather, the chromatin content of the chromosome is in the form of small granules collected about a middle point, the number of these middle points corresponding to the reduced number of chromosomes and to the number of chromosome pairs. One can actually see the granules form a body which becomes divided into halves. STRASBURGER conceives that the granules leave the linin thread that there may be a freer interchange among them than would be possible in the case of differentiated chromosomes. He proposes the term *gamosome* for the individual chromatin granules, and *zygosome* for the body which they form. From each zygosome comes two chromosomes, in the formation of which the linin takes part. The chromatic gamosomes are the bearers of hereditary qualities, the linin having only a secondary significance. The diminution of chromatin during the resting period of the nucleus is not regarded as evidence that the chromatin is not the bearer of hereditary qualities. In synapsis the individuality of the paternal and maternal chromatin is given up. They unite to form a single zygosome, from which come two new chromosomes. These two chromosomes do not contain exclusively paternal or maternal gamosomes. This throws light on the differences in the offspring of a pair of parents and also upon the splitting of monohybrids. In discussing the question whether each chromosome bears all the hereditary qualities of the organism, some evidence is found in favor of the view that the chromosomes are not of equal value.

A fuller presentation of these views and their relation to current conceptions would be welcome.—CHARLES J. CHAMBERLAIN.